

June 11, 2002

The Honorable Jessie Hill Roberson  
Assistant Secretary for Environmental Management  
U. S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0113

Dear Ms. Roberson:

The staff of the Defense Nuclear Facilities Safety Board (Board) recently reviewed progress in stabilization of plutonium-bearing materials at the Plutonium Finishing Plant (PFP) at the Hanford Site. Although there has been considerable delay in stabilizing materials, the Board commends the progress that has been made at PFP during the last several years toward implementing Recommendations 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*, and 2000-1, *Prioritization for Stabilizing Nuclear Materials*. However, the staff review identified potential inadequacies in the plans for disposition of several unique types of materials and in the control of moisture in stabilized plutonium oxides. The enclosed staff report is forwarded for your information and use as appropriate.

Sincerely,

John T. Conway  
Chairman

c: Mr. Keith A. Klein  
Mr. Mark B. Whitaker, Jr.

Enclosure

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

May 20, 2002

**MEMORANDUM FOR:** J. K. Fortenberry, Technical Director

**COPIES:** Board Members

**FROM:** J. Plaue and R. Kasdorf

**SUBJECT:** Recommendation 94-1/2000-1 Stabilization Activities at Hanford  
Plutonium Finishing Plant

During April 16–17, 2002, the staff of the Defense Nuclear Facilities Safety Board (Board) reviewed the status of Recommendations 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*, and 2000-1, *Prioritization for Stabilizing Nuclear Materials*, at the Plutonium Finishing Plant (PFP) at the Hanford Site. The review was performed by staff members R. Kasdorf, J. Plaue, R. Tontodonato, site representatives M. Sautman and D. Grover, and outside expert J. Leary.

**Recent Progress.** After considerable delay, Hanford is now making good progress towards implementing the recommendations and has developed a reasonable path forward for processing most of its legacy plutonium inventory. Processing of PFP's plutonium-bearing material is scheduled to be completed by early 2004. However, the path forward for some unique items has not yet been determined.

*Plutonium metal and oxide*—In September 2001, packaging of PFP's inventory of plutonium metal to meet DOE-STD-3013, *Stabilization, Packaging, and Storage of Plutonium-Bearing Materials*, was completed. The contractor (Fluor Hanford) used relatively simple equipment designed by Savannah River Technology Center for bagless packaging of the inner container and welding the outer container. Porosity issues with the outer container weld appear to have been resolved, and previously welded containers are expected to be accepted as-is. A new stabilization line has begun stabilizing PFP's 1,500 kilograms of plutonium oxides. The contractor plans to wash some of the plutonium oxides to reduce chloride content to facilitate thermal stabilization and testing for residual volatiles. Plutonium oxide stabilization is about 10 percent complete and is expected to be completed by February 2004.

*Plutonium solutions*—Stabilization of plutonium solutions using magnesium hydroxide precipitation is about 90 percent complete and is expected to be completed by July 2002. Excessive

precipitation of hygroscopic materials, which increased the rate of moisture reabsorption, appears to have been resolved by improved process controls.

*Polycubes*—During the review, the staff observed the start of thermal oxidation of the first batch of polycubes. Approximately 1,600 polycubes will be oxidized in muffle furnaces. Completion of that stabilization and packaging campaign is forecast for March 2003. However, subsequent to the staff's review, oxidation of the polycubes was stopped because of the inability to maintain the minimum air flow required to prevent buildup of flammable gases in the furnace.

*Residues*—Stabilization of plutonium-bearing residues, primarily sand, slag, and crucible, is scheduled to be completed by November 2003. To date, about one-third of these residues have been packaged into pipe-overpack containers for shipment to the Waste Isolation Pilot Plant (WIPP).

### **Unique Item Disposition.**

*Organic solutions*—Two four-liter glass containers of a plutonium-bearing organic solution pose a disposition challenge. The solutions were generated in 1979 in the Plutonium Reclamation Facility (PRF) solvent extraction process. The solutions contain a small quantity of plutonium (about 17 grams), as well as the degradation products of the chemicals used in that process (carbon tetrachloride, tributyl phosphate, and dilute nitric acid). The chemicals have degraded to a highly viscous liquid consisting of mono- and dibutyl phosphate. The contractor is planning to package the glass containers in vented bags placed within a padded drum, and then ship the material to the Central Waste Complex for interim storage. The contractor intends to eventually dispose of this material at WIPP as transuranic waste. The staff had the following observations on the planned disposition path:

- ! It would be prudent to formally confirm that this organic solution can be disposed of at WIPP without further stabilization or repackaging before shipping the material to the Central Waste Complex for interim storage. In particular, it is not clear that this item will pass gas generation testing required for shipment to WIPP. Treatment and/or repackaging may be required. PFP has significant processing and repackaging capabilities, and is a more robust facility for interim storage than the Central Waste Complex.
- ! It would be prudent to determine whether similar material exists elsewhere at the site, particularly in PRF. Similar material may exist as hold-up in PRF process equipment.

*High plutonium-238 drums*—Twelve drums containing plutonium with a high plutonium-238 content are currently retrievably stored in the site's burial ground. These drums are included as part of a 15,200 drum retrieval campaign which the contractor plans to have complete by September 2006. The material originated from Savannah River Site (SRS) and was used in criticality experiments. Each drum contains approximately 500g of plutonium, of which roughly 18 percent is plutonium-238. The

drums were buried for storage in 1977, at which time thermal studies calculated the peak internal package temperature to be 682°F. The contractor has not yet developed sufficient planning to safely disposition these drums. The staff believes the material form is not a suitable, stabilized waste form and should be included with other materials in Recommendation 94-1 planning. Issues that are currently inadequately addressed include:

- ! A final disposition path needs to be determined. The contractor believes the drums can be sent to either SRS or to Los Alamos National Laboratory (LANL) for possible inclusion in the plutonium-238 scrap recovery process. Based on the impure isotopic content, this material may not be appropriate for the LANL recovery process.
- ! A hazards analysis needs to be performed in order to develop safe retrieval and handling procedures. The high specific activity and associated heat content of these drums pose a unique hazard compared to other drum retrieval activities.
- ! An appropriate facility needs to be available for handling/repackaging processes.

**Moisture Measurement and Control.** DOE-STD-3013 requires the moisture content of plutonium oxide materials to be low (<0.5 percent) to preclude over-pressurization of the container. Typically, a sample is taken just before the oxide is sealed into the inner container to confirm the moisture content meets the standard. The standard allows deferred packaging of the oxide into the inner container if the material is placed into a closed container at the time of stabilization and is re-weighed when finally placed into the inner container. Any weight gained during this period is considered additional moisture, and counts toward the 0.5 percent limit.

The staff identified several issues regarding interim storage of stabilized plutonium oxides prior to packaging into a sealed inner container. Specifically:

- ! After stabilization and sampling, the contractor places stabilized plutonium oxide in a vented convenience container for interim storage. Use of a vented container is contrary to the storage standard. Additionally, it is a poor practice to leave thermally stabilized plutonium oxide materials open to a humid environment even if the material subsequently can be shown to meet the moisture requirements.
- ! Although the contractor's stated practice is not to delay packaging into the sealed inner container, the storage period between re-weighing and final sealing can be prolonged. The only limit imposed by the contractor on the duration of the time between re-weighing and placement into the inner container is that the period be less than the time between the initial weighing and re-weighing, which in several cases has extended to hundreds of hours.

- ! The contractor uses a potentially non-conservative extrapolation method to estimate moisture reabsorption between re-weighing and final packaging. Such extrapolation could be non-conservative depending on the relative humidity in the glovebox during this period.

**Material Surveillance.** DOE-STD-3013 requires periodic surveillance of packaged material. DOE has developed an Integrated Surveillance Program (ISP) to coordinate the surveillance activities across the DOE complex. The contractor is currently in the process of implementing the ISP. In conjunction with the ISP, LANL is conducting a shelf-life program for the various materials packaged to DOE-STD-3013 in its Material Identification and Surveillance (MIS) program. The standard requires that each site ensure that its oxide materials are represented in the MIS program. Contractor personnel indicated they believe PFP material types are represented in the MIS program since there are samples in the program which bound the chloride and the moisture content of PFP material. The staff does not believe bounding in this manner is sufficient or consistent with the intent of the standard. PFP personnel indicated they would perform a cross-walk to demonstrate that PFP's plutonium oxide inventory is adequately represented in the MIS program.

**Alternative Plutonium Storage.** DOE has recently begun planning to accelerate decommissioning of facilities within the complex. The contractor has proposed accelerating demolition of PFP to September 2009. This schedule is contingent on emptying the PFP vaults by 2005. The current plan is to ship the material to SRS for storage and eventual disposition. Given the current inability to ship material to SRS, DOE tasked the contractor to evaluate alternative onsite storage capability. The contractor believes the best storage alternative may be to convert one of the four abandoned grout vaults to an unmanned plutonium storage facility. The vaults are robust steel-reinforced concrete facilities designed to meet Resource Conservation and Recovery Act requirements, and the contractor stated that they are seismically qualified in both empty and full configurations. The only major modification identified would be an access point for material receipts. No safety evaluations have been done, and no consideration has been given to what safety systems would be required. The staff had the following observations on the grout vault proposal:

- ! The current state of the vaults is unknown. The staff was informed that the last entry into a vault was in 1992. Before additional resources are spent on the planning effort, it would be prudent to examine the interior of the vault for signs of deterioration (cracking, pooled water, etc.).
- ! An acceptable surveillance program that meets the requirements of DOE-STD-3013 must be developed.